

SUB
1. (Three Times Amended) A semiconductor wafer boat comprising:

a) a first end and a second end;

b) a plurality of slots positioned between the first and second ends for receiving semiconductor wafers therein, the semiconductor wafers being substantially circular and having an upper area and a lower area, each of the slots comprises first and second upper support guides to maintain the semiconductor wafers in a vertical orientation during wafer processing at elevated temperatures between approximately 1000 °C to 1400 °C; and

c) an arcuate lower grooved portion for receiving and supporting the lower area of the semiconductor wafers, wherein at least a part of the lower area of the semiconductor wafers contacts the lower arcuate grooved portion such that the lower arcuate grooved portion substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion and which supports the weight of the semiconductor wafer positioned thereon; and

d) at least one window positioned not more than 10 mm from the first and second ends of the boat, wherein the one or more windows increase radiation distribution about the wafers in the boat when the boat undergoes processing at elevated temperatures.

orig. cl 9 p. 10 indicates not less than 10 mm

original claim 10
112, 1st N.M.

REMARKS

Upon entry of the present amendment, Claims 1-8 are pending in this application. The present amendment does not introduce new matter.

Claims 1-13 have been rejected.

Claims 9-13 have been canceled.

Claim 1 has been amended. Support for the amendments in claim 1 can be found in the specification on page 10, lines 15-17, and page 11, lines 15-18.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

No disclosure that positioning from ends relates in any way to "wherein" function/mix. See p. 11

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

The Examiner's rejections and objections will be addressed in turn as set forth in the Office Action.

I. **DRAWINGS**

Figure 1 has again been objected to. The Examiner states that since Figure 1 is a prior art drawing, reference numerals "10", "12", "14", "18a", "18b" and 22 in Figures 2-4 should be changed to other different reference numerals because the prior art and applicant's own invention are completely separate figures and the respective figures cannot share the same reference numerals. because Figure 1 is prior art and is not labeled as such. A proposed drawing correction is submitted with this Response as required in the Office Action. The new reference numerals are indicated in red. The specification has also been amended to recite the new reference numerals used in Figures 2-4. Applicant has arranged for formal correction of the noted defect and such corrected formal drawings will be submitted when the application is allowed.

II. **INFORMATION DISCLOSURE STATEMENT**

The Office Action recites that the IDS filed on February 21, 2002 has not been considered because complete copies of the U.S. and foreign patents recited in the IDS did not accompany the IDS as filed. Complete copies of the references listed in the IDS filed on February 21, 2002 accompany this Response.

III. **REJECTION UNDER 35 U.S.C §112, PARAGRAPH ONE**

Claims 1 and 11 have been rejected under 35 U.S.C §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor, at the time the application was filed, had possession of the claimed invention. The Examiner states that the recitation of "said plurality of slots" on the arcuate lower grooved portion (20) is considered to be new matter because there is no support in the specification of the lower arcuate supporting groove to have a plurality of slots thereon.

With all due respect, the claims do not recite a “plurality of slots” **on** the arcuate grooved portion (emphasis added) as the Examiner recites on page 3 of the Office Action. In claim 1, element (b) recites “a plurality of slots positioned between the first and second ends for receiving semiconductor wafers therein.”. Element (c) of claim 1 recites, in relevant part, that “...at least part of the lower area of each of the semiconductor wafers in said plurality of slots contacts the lower arcuate grooved portion...”. Support for the “plurality of slots” can be found in the specification on page 11, line 15 which recites “...wafers positioned in the slots”. Additional support for the “plurality of slots” is found on page 12, lines 19 and 20 which discuss that the total possible capacity of the inventive boat for use with 300 mm wafers was 25 wafers. Further, the specification on page 13, lines 6-7 teaches another embodiment of the wafer boat having 10 slots to hold 10 wafers. With respect to claim 11, this claim has been canceled and the rejection thereto is moot.

Accordingly, Applicants respectfully submit that there is adequate support in the specification for the phrase “said plurality of slots” and that the Examiner’s assertion that “said plurality of slots” is **on** the arcuate grooved (20) is incorrect. Reconsideration and withdrawal of the rejection on these grounds is respectfully solicited.

IV. REJECTION UNDER 35 U.S.C §103

Claims 1-13 stand rejected under 35 U.S.C §103(a) as being unpatentable over U.S. Pat. No. 5,538,230 to Sibley (hereafter referred to as “Sibley”).

Obviousness requires that there be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant. (*In re Kotzab*, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)).

As recited in Applicant’s previous response dated June 4, 2001 (and resubmitted on September 4, 2001), Sibley is directed to a wafer carrier comprised of a single piece of silicon carbide configured as a cylindrical shell section (22) and which has an outer convex surface (23) and an inner concave surface (24). The cylindrical shell (22) lies outside the radius of inner concave surface (24). The boat (20) disclosed in Sibley has four slot-containing inwardly convex surfaces (34) which extend toward the wafer center to a distance r3. Surfaces (34) are provided with a plurality of grooves or slots (35) into which the wafers are placed. This embodiment is illustrated in Fig. 1 of Sibley. In an alternative embodiment disclosed in Sibley, and illustrated in Fig. 3, the boat

is provided with only two inwardly extending surfaces (34), each of which has a row of slots (35) equally spaced along the longitudinal axis of the cylindrical shell.

In relevant part, the present Office Action recites on page 4 that:

[T]he “plurality of slots (75) [in Sibley] on the wafer boat are located on the first (left side) and second (right side) upper supporting guides (slots 35) and the lower groove portion (74), see column 5, lines 48-50, wherein the bottom of semiconductor wafer is in contact and supported by the slot on the lower arcuate grooved portion, ...”

See argument to left

With all due respect to the Examiner, Sibley does not teach **“a lower arcuate grooved portion for receiving and supporting the lower area of the semiconductor wafers,** wherein at least a part of the lower area of the semiconductor wafers contacts the lower arcuate grooved portion such that the lower arcuate grooved portion **substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion** and which supports the weight of the semiconductor wafer positioned thereon;” as recited in element c) of amended claim 1 (emphasis added).

Element (74) recited in Sibley in col. 5, line 74 is not an arcuate grooved portion as recited in the Office Action, but rather is referred to in Sibley as “three inwardly extending surfaces 74”. As recited in amended claim 1, the lower arcuate grooved portion **“substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion...”** (emphasis added). As recited in element (b) of amended claim 1, the wafers are “substantially circular”. Since Sibley teaches that element 74 is an “inwardly extending surface[s]”, even if element 74 was in fact an arcuate groove as the Examiner proposes, it would not have the capability to **substantially conform** to the at least a part of the lower area of the circular semiconductor wafers that contact it (emphasis added).

Furthermore, as amended, claim 1 recites at least one window positioned not more than 10 mm from the first and second ends of the boat, wherein the one or more windows increase radiation distribution about the wafers in the boat when the boat undergoes processing at elevated temperatures. The Examiner states that the wafer boat described in Sibley has “at least one window (32) positions substantially in a small distance in from the distal end of the boat.” In col. 5, lines 19-20, the element (32) that the Examiner refers to as a “window” is actually a “cut out” for use in

inserting lifting devices from one side." The windows of the wafer boat of the present invention serve the purpose of increasing radiation distribution about the wafers when the boat undergoes processing at elevated temperatures as recited in the specification on page 10, lines 15-17 and on page 11, lines 15-18.

With respect to independent claim 11, this claim has been canceled and the rejection thereto and to the claims that depend therefrom, are thus moot.

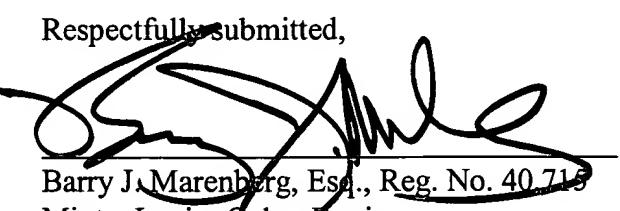
By the amendments made to claim 1, and the arguments submitted herein applicant believes that the semiconductor wafer boat of amended claim 1 is not obvious in view Sibley. Claims 2-8 depend directly or indirectly from amended claim 1 and thus incorporate all the limitations of amended claim 1 therein. Since amended claim 1 is believed to be allowable, claims 2-8 are believed to be allowable for at least the same reasons. Reconsideration and withdrawal of the rejection on these grounds is respectfully solicited.

VI. CONCLUSION

Applicant has made a significant contribution to the art, neither disclosed nor suggested in any cited reference. It is submitted that all claims are in condition for immediate allowance, which action is respectfully solicited.

If, upon receipt and review of this amendment, the Examiner believes that the present application is not in condition for allowance and that changes can be suggested which would place the claims in allowable form, the Examiner is respectfully requested to call Applicant's undersigned counsel at the number provided below.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

Paragraph beginning at page 10, line 18 and extending to page 11, line 18, has been amended as follows:

--Taking the several considerations outlined above into account, the inventive wafer boat was developed. FIGS. 2 and 3 are schematic representations of one embodiment of the wafer boat [10] 30 in accordance with the present invention, as viewed from different angles. In particular, unlike current wafer boats which provide support for each wafer at four points (two lower points to support the weight of the wafer, and two upper points to maintain the wafer in the vertical orientation as illustrated in FIG. 1), the wafer boat of the present invention is provided with two upper support guides [18a, 18b] 36a, 36b to maintain the wafer [12] 32 in the vertical orientation, and a single lower supporting grooved portion [20] 38 to support the weight of the wafer [12] 32. Once the material of which wafer boat [10] 30 is fabricated is selected, the supporting grooved portion [20] 38 which is in a plane lower than the upper support guides [18a, 18b] 36a, 36b, is shaped having an arcuate configuration such that, when the wafer [12] 32 and wafer boat [10] 30 are subjected to wafer processing temperatures of about 1000 °C and above, the shape of the supporting grooved portion [20] 38 will substantially correspond to the shape of the part of the wafer [12] 32 contacting the supporting grooved portion [20] 38, thereby supporting the wafer [12] 32 across the entire arcuate portion of a circular wafer's periphery which is in contact with the supporting grooved portion. In other words, the lower arcuate periphery of the circular wafer rests upon and is supported by the supporting grooved portion [20] 38 when the wafer [12] 32 is positioned in a slot [14] 34 in wafer boat [10] 30 and maintained in a vertical position by the upper support guides [18a, 18b] 36a, 36b. The wafer boat [10] 30 having this configuration provides exceptional support for and stabilization of the [waters 12] wafers 32 positioned in the slots [14] 34. Additionally, the wafer boat [10] 30 of the present invention includes one or more large openings or windows [22] 40

between each end of the boat in order to increase the radiation view factors and decrease radiation blocking caused by the boat, as compared to boats currently known in the art. --

Paragraph beginning at page 11, line 19 and extending to page 12, line 2, has been amended as follows:

-- Since they are formed of different materials, the wafer [12] 32 and the wafer boat [10] 30 have different thermal expansion coefficients. In one embodiment, the wafer boats of the present invention are formed of SiC. One preferred SiC comprises recrystallized SiC commercially available from Saint-Gobain Industrial Ceramics Inc., of Worcester, Massachusetts under the tradename CRYSTAR®. Such materials can comprise either recrystallized SiC or silicon impregnated SiC where semiconductor grade silicon has been used to fill porosity in the body. The silicon impregnated material can be further provided with a layer of CVD-SiC to seal the surface and prevent silicon migration during use of the device in wafer processing.--

In the claims:

Claim 9-13 have been canceled.

Claim1 has been amended as follows:

1. (Three Times Amended) A semiconductor wafer boat comprising:

- a) a first end and a second end;
- b) a plurality of slots positioned between the first and second ends for receiving semiconductor wafers therein, the semiconductor wafers being substantially circular and having an upper area and a lower area, each of the slots comprises first and second upper support guides to maintain the semiconductor wafers in a vertical orientation during wafer processing at elevated temperatures between approximately 1000 °C to 1400 °C; and
- c) an arcuate lower grooved portion for receiving and supporting the lower area of the semiconductor wafers, wherein at least a part of the lower area of the semiconductor wafers contacts the lower arcuate grooved portion such that the lower arcuate

grooved portion substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion and which supports the weight of the semiconductor wafer positioned thereon[.]; and

- d) at least one window positioned not more than 10 mm from the first and second ends of the boat, wherein the one or more windows increase radiation distribution about the wafers in the boat when the boat undergoes processing at elevated temperatures.

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